

AD-A207 987

4



**A  
E  
H  
A**

**UNITED STATES ARMY  
ENVIRONMENTAL HYGIENE  
AGENCY**

ABERDEEN PROVING GROUND, MD 21010-5422

ARMY OCCUPATIONAL HEALTH AND AEHA

by

A. D. KNEESSY

May 1981

DTIC  
MAY 16 1989  
S H D

88 10 092

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE				Form Approved OMB No 0704-0188 Exp Date Jun 30, 1986	
1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.		
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S)			5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a. NAME OF PERFORMING ORGANIZATION U.S. Army Environmental Hygiene Agency (USAEHA)		6b. OFFICE SYMBOL (If applicable) HSHB-MO-D	7a. NAME OF MONITORING ORGANIZATION		
6c. ADDRESS (City, State, and ZIP Code)  Aberdeen Proving Ground, MD 21010-5422			7b. ADDRESS (City, State, and ZIP Code)		
8a. NAME OF FUNDING/SPONSORING ORGANIZATION		8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER		
8c. ADDRESS (City, State, and ZIP Code)			10. SOURCE OF FUNDING NUMBERS		
			PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.
					WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) Army Occupational Health and AEHA					
12. PERSONAL AUTHOR(S) A. D. KNEESSY					
13a. TYPE OF REPORT Handout		13b. TIME COVERED FROM _____ TO _____		14. DATE OF REPORT (Year, Month, Day) May 1981	
				15. PAGE COUNT 8	
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP			
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Army Occupational Health and AEHA is a handout written by COL A.D. Kneessy, former commander, USAEHA. The purpose of the handout is to--  a. Briefly review AEHA's historical development.  b. Examine some of the current occupational and industrial hygiene programs.  c. Touch on future program efforts.					
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT <input checked="" type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL M. BARBARA DONOVAN			22b. TELEPHONE (Include Area Code) (301) 671-3254		22c. OFFICE SYMBOL HSHB-MO-D

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted  
All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE

UNCLASSIFIED

*The Army, Industrial Hygiene Agency*  
ARMY OCCUPATIONAL HEALTH AND AEHA

(AEHA) recently celebrated 38 years of continuous service in support of occupational health programs of the Army - thus the title. My aim is to briefly review our historical development, examine some of our current occupational and industrial hygiene programs, and touch on future program efforts. *→ The purpose of this report is to*

I had always thought that the establishment of the Agency in 1942 marked the Army's first organized effort in industrial hygiene. As Stanhope Bayne-Jones points out in his excellent monograph on the evolution of preventive medicine<sup>1</sup>, in May 1917 the Army Surgeon General was charged with gas defense, and oversaw the construction and supervision of a gas defense plant manufacturing gas masks and other protective materials. It was soon realized that such plants required sanitary supervision geared to specific hazards to protect workers from potential exposure to varying gas concentrations. Collaborating with the Bureau of Mines, The Surgeon General established inspection programs for both government owned and operated, and contractor owned and operated gas factories. Thus, the first Medical Department participation in sanitary control in industrial plants resulted from a concern with poisonous gases and chemical warfare. The end of the great war signalled a hiatus in industrial hygiene efforts by the Army Medical Department. When the next wartime buildup occurred, it would be necessary to depend totally on the civilian sector.

Fortunately, the period between the wars saw the emergence of active industrial hygiene programs in Federal, State and local governments, and in industry. Concurrently, occupational and industrial hygiene training was receiving new emphasis in the various graduate schools of public health. A civilian cadre of soon to be citizen soldiers was providentially available when the small United States Army was thrust into managing health problems in a mushrooming industrial complex.

The initial Army concern for general control of occupational health hazards occurred in August of 1938 when the Chief of Ordnance requested medical care for its civilian employees. The rapid expansion of medical treatment facilities for 400,000 workers is well documented in the History of Preventive Medicine in World War II, published by The Surgeon General of the Army.<sup>2</sup>

---

<sup>1</sup> Stanhope Bayne-Jones, M.D. The Evolution of Preventive Medicine in the United States Army, 1607-1939. Office of The Surgeon General, Department of the Army, Washington, DC, 1968, US Government Printing Office.

<sup>2</sup> Preventive Medicine in World War II, Volume IX, Special Fields, Office of The Surgeon General Department of the Army, Washington, DC, 1969, US Government Printing Office.

Rapid mechanization within the Army and creation of the Armored Force in 1940 raised questions on environmental hazards of tank warfare. The Armored Medical Research Laboratory was established in October 1942 to examine these hazard areas. Research was directed to toxic gases in tanks, protection of tank crews against fires, vision and fire control, dust exposures, noise and blast exposures, tank crew fatigue factors, protection of tank crews against chemical agents, physiologic characteristics of tanks and human engineering. Research in high temperature and cold weather operations was also undertaken.

The Army Industrial Hygiene Laboratory, established in November 1942, was to conduct surveys and investigations concerning occupational health hazards in Army-owned and operated industrial plants, arsenals and depots. The mission was later extended to privately owned and operated ordnance explosive establishments. The mission was oriented to existing operations, did not envision a strong research effort, and, at its inception, was limited to civilian employees. Organizationally, the laboratory had four operating sections; industrial hygiene survey, chemistry, engineering design and medical. The concept of operation was to conduct periodic surveys at approximately 98 installations of which 15 were privately owned and operated. The employee population averaged 321,000. Although industrial dispensaries and hospitals had been established at most locations, industrial hygiene support was almost exclusively the AIH Laboratory's responsibility. As we will see later, this concept of centralizing industrial hygiene resources has been changed in recent years.

Employee exposures were both military unique and those common to equipment and vehicle maintenance operations. Ammunition loading plants were the most hazardous facilities due to open handling of dusty and fuming compounds. Toxic exposures of concern included TNT, amatol, pentolite, tetryl, RDX, lead oxide, mercury fulminate and nitroglycerine to name a few. In the high explosive and chemical manufacturing plants additional exposures included acids, nitrocellulose, diphenylamine and ethyl alcohol. Since the basic principle involved in high explosive and smokeless powder manufacturing is the nitration of organic compounds, the prevention of exposure to lethal concentrations of oxides of nitrogen was of paramount concern. Fortunately, these last processes were enclosed and control was supplemented by local exhaust ventilation. I might add here that the air pollution aspect was not even considered in those days. Small arms plants by comparison were quite clean, but exposures to lead, solvents, cutting oils and coolants were widespread. Army arsenals and depots had exposures to solvents, paints, and chemicals related to repair, maintenance and renovation of ordnance materiel. In many cases the IH Laboratory personnel were applying industrial hygiene technology to either new or greatly expanded operational situations. The chemistry section developed new and improved methods of atmospheric sampling and analysis, the engineering design section dealt primarily with mechanical airflow systems and the medical section became more and more involved in toxicological evaluations of fungicides, insecticides, repellents, flame retardants and other items with troop and industrial application.

List		Specimen	
A-1			

What was the World War II occupational disease experience? In 968,000 man-years of operations in explosive manufacture there was a total of only 28 occupational disease fatalities (22 from TNT, 3 from oxides of nitrogen, 2 from carbontetrachloride and 1 from ethyl ether). This was a rate of three fatalities per 100,000 workers per year or five deaths per billion pounds of explosives produced. In World War I the rate had been 230 deaths per billion pounds produced. There were 2.4 cases per 1000 man-years of illness and dermatitis, resulting in lost time. Since dermatitis accounted for two-thirds of lost time cases, the more serious systemic illnesses had a rate of 0.8 cases per 1000 man-years of production. These rates were a small fraction of the World War I rates with a very limited production effort. The efforts of the 44 personnel of the Industrial Hygiene Laboratory appeared to have justified its existence and it was firmly established. In 1945 it was concluded that the laboratory (then located at Edgewood Arsenal) would be able to make even more significant contributions to the safety and health standards of all War Department installations. Thus, this small laboratory was the seed from which evolved the present day Agency of over 400 personnel operating 31 diverse mission programs. The expansion of missions and the personnel growth stemmed from The Surgeon General's practice of adding to existing medical engineering and scientific expertise rather than establishing new organizations for every new requirement. Thus, redundancy of effort was minimized.

The end of World War II was the beginning of the nuclear age and attendant Medical Department responsibilities for radiation protection programs beyond the traditional concern for x-ray protection. The Health Physics Division was established and presently exists to provide field survey and consultative assistance for Army users of all sources of ionizing radiation. Another product of World War II research, RADAR, was just the beginning of widespread microwave generation. The Laser-Microwave Division is now the Army's leader in the health and environmental aspects of all RF and visible radiation applications.

In the early 1950's a small sanitary engineering division was formed to address water pollution by TNT wash out from munition demilitarization. Additional waste water pollution abatement projects plus heavy involvement in field water supply quality control during the Korean conflict were the beginning of our present Water Quality Engineering Division. The increasing national attention to environmental enhancement has spawned the Air Pollution Engineering Division and the Waste Disposal Engineering Division to complete the Environmental Quality Directorate. I touch on these developments in the environmental enhancement area to point up once again The Surgeon General's concept of building on existing expertise. There is a constant interplay between industrial hygiene and air pollution personnel when rigid emission limits are applied to air exhausted from processing areas to protect health. Waste disposal efforts to implement the hazardous waste disposal sections of the Resource Conservation and Recovery Act must include input on the health and safety of operating personnel. Consolidation of almost all analytical support functions in 1972 within one directorate has insured interchange and exchange of knowledge and expertise in industrial hygiene, water,

waste-water, air and radiological chemistry. These specialties, coupled with the long operating Toxicology Division, give the Director of Laboratory Services a broad based and in-depth support capability. I have digressed into these other operational areas to impress upon the reader the wide diversity of the Army Environmental Hygiene Agency as it exists today.

To return to our first concern, the Army's occupational health program. According to the Army Occupational Health Program Report for 1979, our supported work force was 258,526 civilians and 472,691 military for a total of 731,217 personnel. There were 3.9 cases per 1000 persons of occupational illness reported (55.83 injuries per 1000). The Occupational and Environmental Medicine division physicians and nurses provide consultations and program reviews for operating personnel at installation level. The optometrists conduct occupational vision surveys covering visual acuity by job description and eye protection programs. In this case, there is a direct interface with the Army safety program. The Industrial Hygiene Division acts as a base for providing the technical support to implement the DA Industrial Hygiene Program and provide assistance to all Army installations and other federal agencies. The Industrial Hygiene Division carries out standard or classical industrial hygiene functions to include the scheduled surveys, special studies, program consultations, document and specification review, and revision and preparation of industrial hygiene technical guides. In the early 1960s decentralization of industrial hygiene resources occurred with the establishment of Environmental Health Engineering Services in the CONUS Army areas. With the reorganization of the Army in 1973, these additional personnel were placed in the three regional divisions of the AEHA. These personnel provide similar technical support as the IHD and are under centralized mission program coordinators.

Historically, the field application of industrial hygiene consisted primarily of what was termed comprehensive surveys which have been conducted approximately every 3 years in addition to some special studies. During comprehensive surveys, all operations and activities were evaluated to determine exposures and the adequacy of controls. The information provided by these comprehensive surveys has contributed a great deal toward protecting the health of our work force. The principal customers for these services are the depots, arsenals, and ammunition plants of the Army Materiel Development and Readiness Command (DARCOM). Special studies and detailed in-depth evaluations of specific operations or activities, are conducted upon request at DARCOM, Forces Command, and training command installations, posts, camps and stations. These studies generally involve extensive sampling so that the operation or activity can be effectively characterized. Most recently the attitude toward industrial hygiene has changed dramatically because of OSHA and a renewed public interest in occupational health. OSHA is of special significance because of the prescribed surveillance procedures and requirements that have already appeared as law. These surveillance procedures are, of course, in addition to medical surveillance and medical monitoring requirements. An industrial hygiene evaluation conducted every 2 or 3 years will not suffice, nor will an annual visit be adequate. Industrial hygiene as part of occupational health must now be practiced on a daily basis.

Practicing industrial hygiene on a daily basis means on-site support and this is what we are now trying to effect. The real backbone of the Army Industrial Hygiene Program should be the health and environment personnel located at the installation level and the 34 industrial hygienists and industrial hygiene technicians at the DARCOM facilities. These personnel provide on-site industrial hygiene support. In addition, they conduct and maintain the industrial hygiene hazards inventory which is the basic ingredient of any occupational health program. The industrial hygiene division is providing the primary training for DARCOM industrial hygienists and industrial hygiene technicians and the sampling equipment to operate their industrial hygiene program. This includes calibration and minor repair and maintenance. As industrial hygiene begins to be practiced more and more on the local level, the Industrial Hygiene Division will shift its effort toward that of a consultant role to provide specialized services in the form of special studies, to attack Army-wide or common industrial hygiene problems, to provide current guidance to field users in the form of technical guides, and to maintain contact, and provide input to standards establishing organizations such as OSHA, ACGIH, and ANSI. The standard comprehensive surveys will be replaced by in-depth studies of problem areas surfaced as a result of maintaining the local industrial hygiene inventory.

Let us look at some recent operations. The US Army has undertaken the demilitarization of obsolete and excess chemical munitions. The demilitarization of the munitions involves disassembly of the weapon, removal of the chemical agent, neutralization of the agent, and disposal of the residual chemical salts. In 1972, the US Army began the demilitarization of munitions on a production basis at Rocky Mountain Arsenal, Denver, Colorado. At the request of the Project Manager, USAEHA became involved in the industrial hygiene aspects of this program. This involvement has been principally in local exhaust ventilation design guidance, atmospheric monitoring and medical surveillance requirements. Since the objective was an exposure level as close to zero as possible, new and extremely precise sampling and analytical techniques were utilized.

Another demilitarization system is currently in operation at Tooele Army Depot, Utah. This system started up in 1979 and will continue on into the mid 1980's. Industrial hygiene support to this system will be provided on a continuing basis.

USAEHA was instrumental in bringing about the introduction of an improved protective ensemble for use in industrial type demilitarization operations. This protective ensemble consists of an air-supplied respirator, and an impervious outer garment providing complete protection in hazardous atmospheres. Although the protective ensemble was developed for demilitarization use, it is possible it will gain acceptance and use in other industrial operations which require total protection.

USAEHA, working with The Surgeon General's office, is presently developing occupational exposure limit standards for chemical agents in operations other than demilitarization. Additionally, occupational exposure limits for

explosives not listed by OSHA are to be developed in the future. All of these actions are an outgrowth of experience gained in support of Army unique hazardous operations.

Many industrial operations at military facilities continue to present unique industrial hygiene situations. Unlike most Detroit assembly lines, Army battle tanks, for the most part are hand-made, fitted, and assembled. Parts are welded to the cast body and the high chromium content of armored plate and the heavy duty electrodes present a significant hazard to welders. During one study by the USAEHA staff, a specially altered welding helmet was fitted with sampling ports for breathing zone sampling. This technique was developed when it was found that the common practice of taping filters interiorly was unsatisfactory. Breathing zone levels averaged 0.36 milligrams per cubic meter of hexavalent chromium. This was 36 times the Time Weighted Average proposed by NIOSH and over 3 times the ceiling standard of OSHA. Since local exhaust ventilation was not operationally acceptable, a commercially available air supply device was extensively modified to improve air flow characteristics and was installed inside the welding helmet. Further sampling showed this air curtain technique reduced the breathing zone concentration well below recommended levels. This control technique had one very important aspect, that of high user acceptability which is so vital in the continued use of protective equipment.

In the case of a hydrazine bulk transfer operation (one of three in the Army) the problem was one of contaminant containment and almost total worker protection. That facility was designed as an enclosed system and personnel wear protective suits and masks when in an area of possible exposure. Work area monitoring and stringent medical monitoring is applied to document personal exposure.

Composition B is a high explosive widely used in the US Army. Composition B is a blend of TNT, RDX (cyclotrimethylene trinitramine) and wax. The contaminants of concern are TNT and RDX. Present standards for TNT vary. ACGIH proposes a TLV of  $0.5 \text{ mg/m}^3$  with a ceiling notation based on a study conducted by AEHA even though the study did not suggest it as a ceiling value. Title 29, CFR lists a TWA standard of  $1.5 \text{ mg/m}^3$  and DARCOM applies a standard of  $0.5 \text{ mg/m}^3$  as a TWA. RDX has TWA permissible exposure level of  $1.5 \text{ mg/m}^3$ . Personnel exposures at each of six manufacturing steps and nine loading steps were sampled. Concentrations at all manufacturing steps were well below  $0.5 \text{ mg/m}^3$  due to enclosure and local exhaust ventilation controls. In one loading step, screening of Composition B, the employee was unnecessarily exposed to excessive concentration of TNT due to poor work practices. All RDX concentrations were below the standard of  $1.5 \text{ mg/m}^3$ . This study is typical of detailed operational evaluations to determine exposure potentials and apply controls or personal protective devices to protect the worker.

In the case of armored vehicles the crew members are potentially exposed to transient high concentrations of  $\text{CO}$ ,  $\text{NO}_x$ ,  $\text{SO}_x$  and ammonia from weapon firing. In the case of operational testing of the new Infantry Fighting Vehicle (IFV)



real time ambient monitoring combined with medical surveillance (breath analysis for carboxyhemoglobin) was used to determine whether or not excessive exposure occurred during operational scenarios. Time does not permit a detailed discussion of difficulties and solutions to instrumenting an infantry fighting vehicle for sampling during weapons firing on the move. Suffice to say that vehicle vibration and cramped quarters made miniaturization and the use of microprocessors a necessity. The result of this 2-week around the clock study indicated no hazardous exposure to CO during these particular operational scenarios.

In a recently initiated program, the Medical Systems Safety and Health Branch is tasked to survey Army hospitals within the United States, to identify and recommend corrective action for safety and health hazards. Some of the criteria and standards used to evaluate the hospitals include those of OSHA, the Joint Commission on Accreditation of Hospitals (JCAH), the National Fire Protection Association, the College of American Pathologists, and Department of Army Regulations and Standards. While these surveys cover fire, electrical and general safety, the industrial hygiene aspects of the hospital environment are also evaluated. For example, exposures to anesthetic gases and ethylene oxide are monitored, sound levels are measured, and operations of prosthetic and chemical laboratories are evaluated. Recurring comprehensive surveys will be expanded to include some areas of interest not presently addressed. For example, HEPA filters will be challenged, the adequacy of a facility to serve the handicapped will be evaluated, and a detailed analysis of fire resistive construction, electrical circuitry, electrical capacity and piping will be conducted. As requested by field activities, special studies are being performed on specialized aspects of medical safety and environmental health within the hospital. An objective of these special studies will be solving problems common to medical facilities for application throughout Army hospitals. Another task is the design review of new hospital construction, and electrical and mechanical upgrades to insure applicable safety and health standards and criteria are incorporated into the design.

At present, a continuing study is underway to evaluate the exposure of waste anesthetic gases to operating room personnel in Army hospitals. The objective of our study is to define mechanical design parameters for heating, ventilation, and air conditioning systems and ultimately to recommend the method and criteria for design of the scavenging systems to be used in Army anesthetizing locations. The system requirements will be to maintain time-weighted concentrations of nitrous oxide to 10 parts per million (ppm) and halogenated compounds to 1 ppm.

Noise induced hearing loss is considered the most widespread occupational injury incurred by DA personnel. In 1979, there were 7,229 progressive hearing loss cases identified among the 174,536 personnel in known noise hazardous areas. The scope of the problem is clearly demonstrated by the approximately \$72 million the Veterans Administration pays every year to military members in hearing compensation. The Bio-Acoustics Division of USAEHA has a major mission program supporting the Army's hearing conservation

effort. Hazardous noise levels are identified by installation health and environment personnel. A computerized noise repository with detailed data on common Army noise sources is maintained at USAEHA. Engineering controls are applied when operationally practicable and acoustical engineering consultations are provided by the Bio-Acoustics Division. Since all military personnel experience hazardous noise exposures sometime in their duties, each active duty individual is fitted with and issued a pair of ear plugs. Civilian personnel are so fitted if they work in a noise-hazardous area. Monitoring audiometry is conducted for all personnel routinely exposed. An active training and health education program is aided by pamphlets, technical guides, posters and other health education material prepared by the Bio-Acoustics Division.

The Agency is constantly investigating new sampling and analytical methodologies. We evaluated and improved a new personal sampler for organic vapors based on diffusion principles as opposed to traditional sampling using pumps and adsorption tubes. Sampling of organic vapors is effected by collection of a charcoal impregnated pad contained within a small passive sampler worn by the worker. After exposure the pad is removed from the sampler and subsequently analyzed for organic vapors. Our work with the organic vapor monitor has been published in the AIHA Journal. We have modified the same passive dosimeter to come up with a novel method for sampling ammonia. We have found that by using our modified passive dosimeter which is both specific and sensitive, we can monitor exposures in the 5-60 ppm concentration range with 97% efficiency. We currently are evaluating a concentrator which appears very promising as a means of greatly increasing gas chromatographic sensitivity. The principle of operation involves collection of trace organic compounds in air or water onto adsorption tubes followed by heat desorption into a gas chromatograph. Preliminary results show that benzene in air can be detected in the 50 ppb range and trihalomethanes in drinking water pose no detection problems using the concentrator at below the ppb level. The concentrator is presently commercially available. We believe that this type of instrument will be a necessity in any laboratory involved in assessing environmental contaminants.

I have briefly reviewed some aspects of the evolution of a highly diversified, multi-disciplined organization. AEHA is uniquely equipped by experience and on board expertise to address and develop solutions to many of the complex environmental and occupational health problems facing the Army today. As new areas of concern are surfaced, I am sure we will be tasked with new objectives and goals to achieve. I am also confident that within resource and state of the art limitations, USAEHA will remain at the forefront of the Army Preventive Medicine effort. After all, our motto is "SENTINEL OF HEALTH."